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GPUSPH modeling of waves and currents in the nearshore[1]
ROBERT DALRYMPLE, Northwestern University, MORTEZA DERAKHTI, Applied Physics Laboratory, University of Washington — GPUSPH (www.gpusph.org) is an open-source Smoothed Particle Hydrodynamics code that has been developed since 2009 for application to free surface flows using the massively parallel architecture of the graphics processing unit (GPU) for computational speed Here we show examples of water waves breaking within the surf zone and wave-induced flows in 3D. The basic example consists of two incident synchronous wave trains with different directions. As shown by Dalrymple (JGR, 1975), synchronous wave trains lead to the formation of nodal and anti-nodal lines in the water surface by superposition. This leads to the formation of circulation cells in the nearshore with rip currents flowing offshore on the nodal lines. However, this is only true for small amplitude waves as nonlinear amplitude diffraction leads to waves crossing the linear nodal lines. This leads to isolated wave crests (Wei et al. ,2017) and an increase in the number of waves in the surf zone. This nonlinear effect leads to additional circulation cells within the surf zone. We also examine the magnitude of each term in the wave-averaged equation of motion spatially.

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